



Environmental Remediation Technologies Derived from Space Industry Research

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Commercialization-the Challenge

- As with all technologies, getting the product from the lab, to the field and eventually into the commercial market is the big.....CHALLENGE !
 - Successful transition from lab to field is often termed “the valley of death”
 - So many good ideas prosper in the lab, but fail in their implementation full-scale
 - What are the options to ensure a greater chance of full scale success?

Steps to Consider

- Always start with the end in mind...
 - Every step should have a field-scale alternative envisioned
 - Can it be bought in large quantities?
 - Can it be made using the lab method on a commercial scale?
 - Is it safe to deploy?
 - Does the remedy open up another concern?
 - Will there be a market offering enough sales?

Success is dependant on the three “Ss” in its name

Don't wait to the end to think about S³

● Scalability

- Would it help to engage another company under a non-disclosure agreement early?

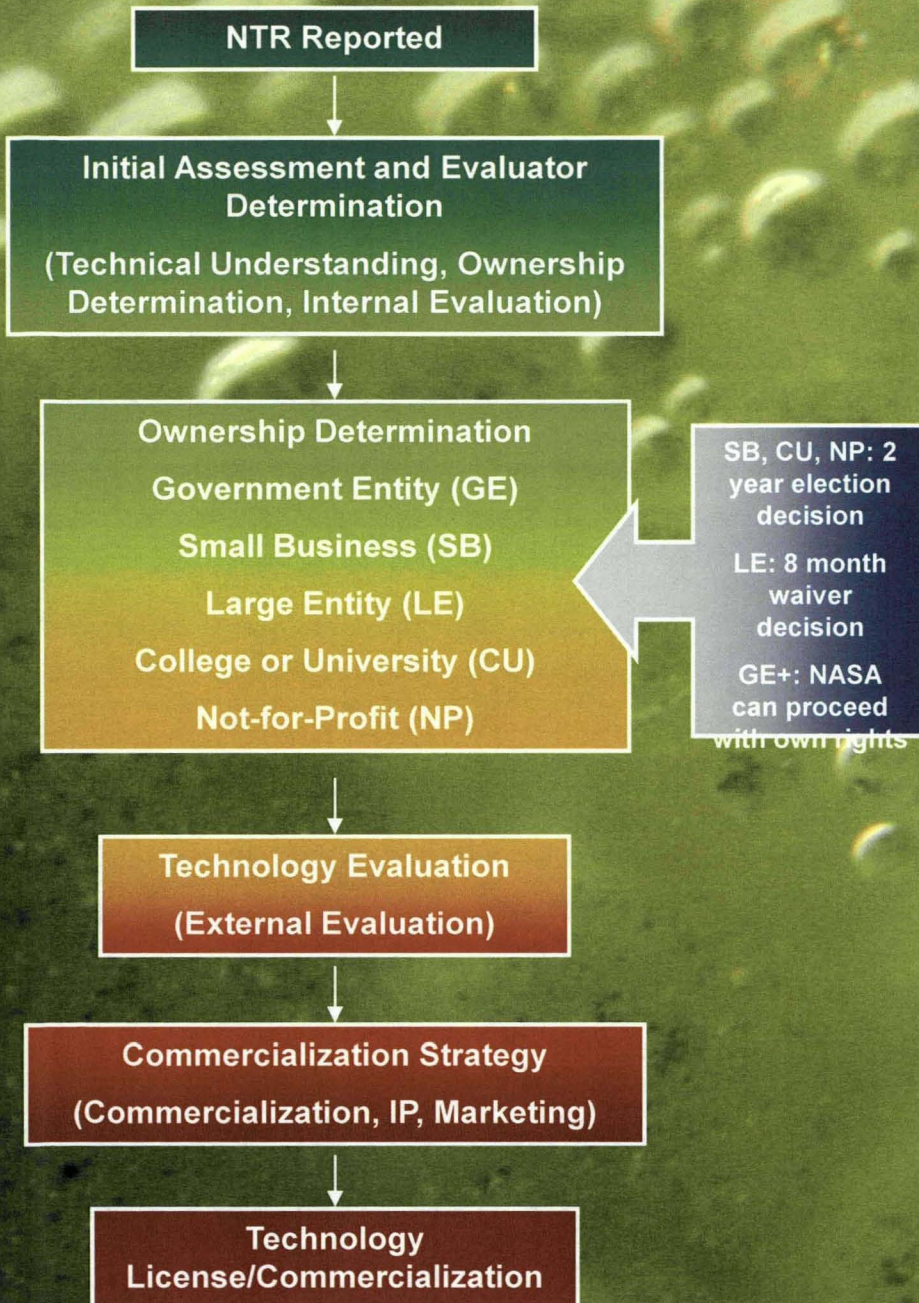
● Safety

- Always verify the means to the end is not initiating another problem

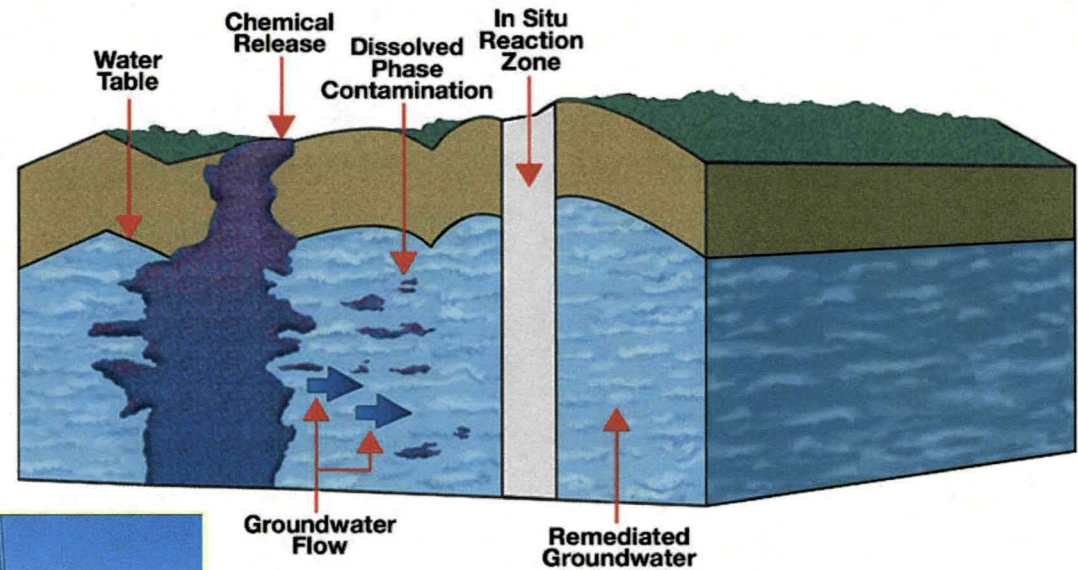
● Sales

- Do a Market Analysis as soon as Intellectual Property is secure. Start sharing information with potential end-users.

NASA's Technology Transfer Route



Deep Wall Emplacement for PRBs



Deep Wall Emplacement for PRBs

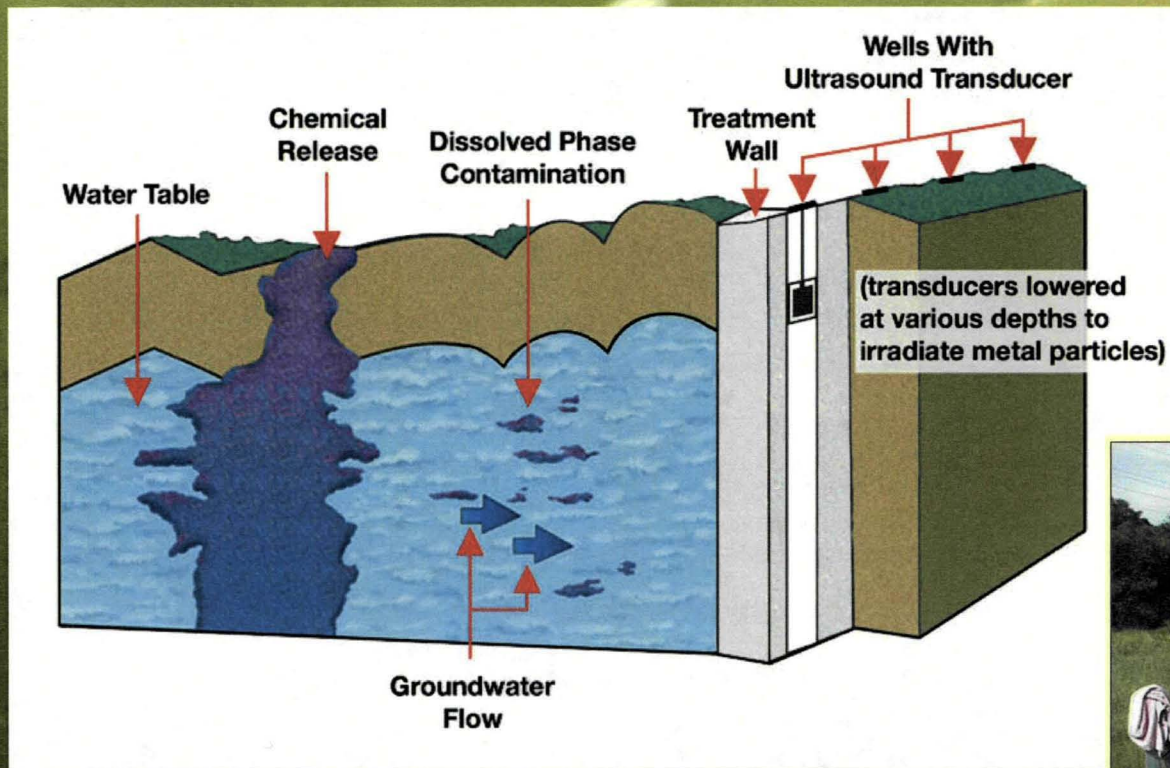
● Benefits

- Emplacement at depths of 100 ft or greater;
- Lowers waste disposal costs.
- Increased permeability in soil around the barrier;
- Eliminates risks associated with open excavations;

● Commercial uses

- Electronic Manufacturers;
- Dry Cleaners;
- Sanitary/Ind. Landfills;
- Auto/Aircraft Facilities;
- Semiconductor Manuf.;
- Solvent Recycling Facilities.

Ultrasound for Performance of PRBs



Ultrasound for Performance of PRBs

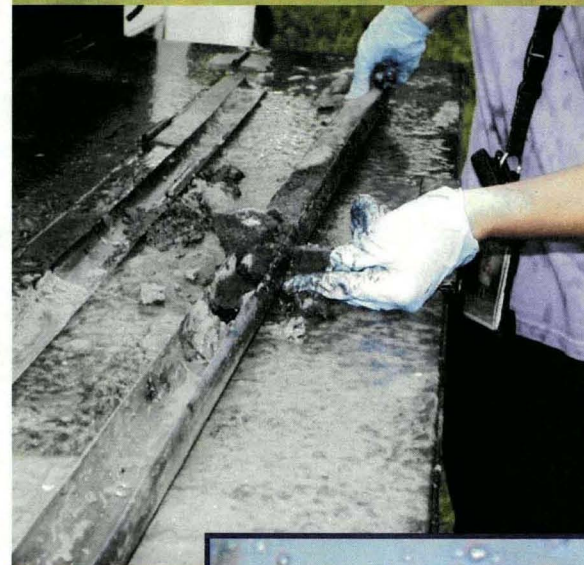
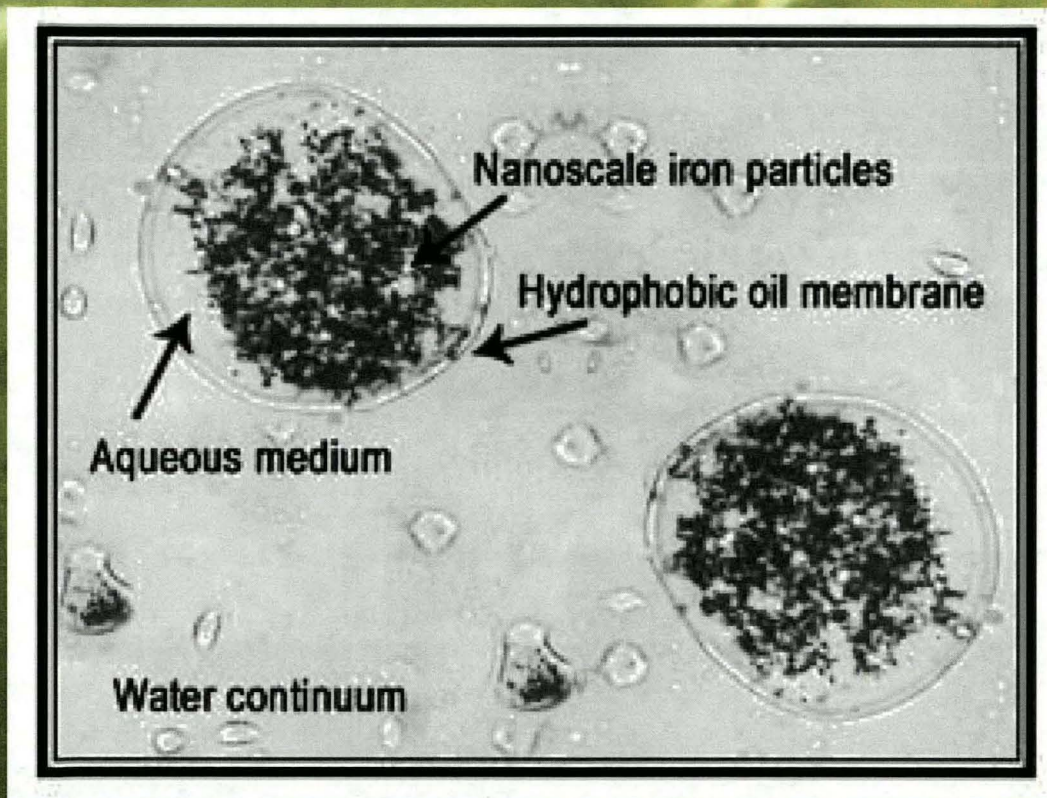
● Benefits

- In situ via intra-wall monitoring wells;
- No removal of soil or reactive media;
- Can be semi-automated;
- Requires no chemicals;
- Generates no undesirable byproducts.

● Commercial use

- Currently installed PRBs throughout the U.S.
- This technology has been licensed by EnviroMetal Technologies Inc. and is available for use.

Emulsified Zero-Valent Iron



Emulsified Zero-Valent Iron

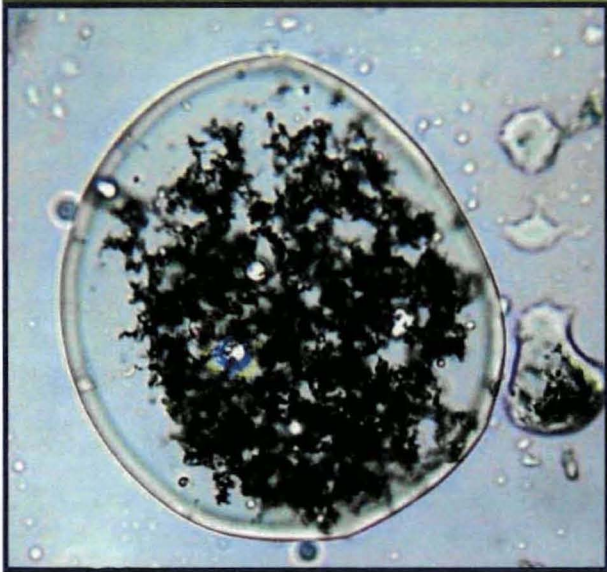
● Benefits

- Directly treats contaminant source;
- Does not mobilize contaminants;
- Requires less treatment time;
- Reduces treatment costs;
- Less toxic and more easily degradable by-products;
- Evaluated by the U.S. EPA Superfund Innovative Technology Evaluation Program;

● Commercial use:

- Dry cleaners;
- Chemical manufacturers;
- Metal cleaning and degreasing facilities;
- Pharmaceutical manuf.;
- Adhesive and aerosol manuf.;
- Government facilities;

Emulsion for Metal and PCB

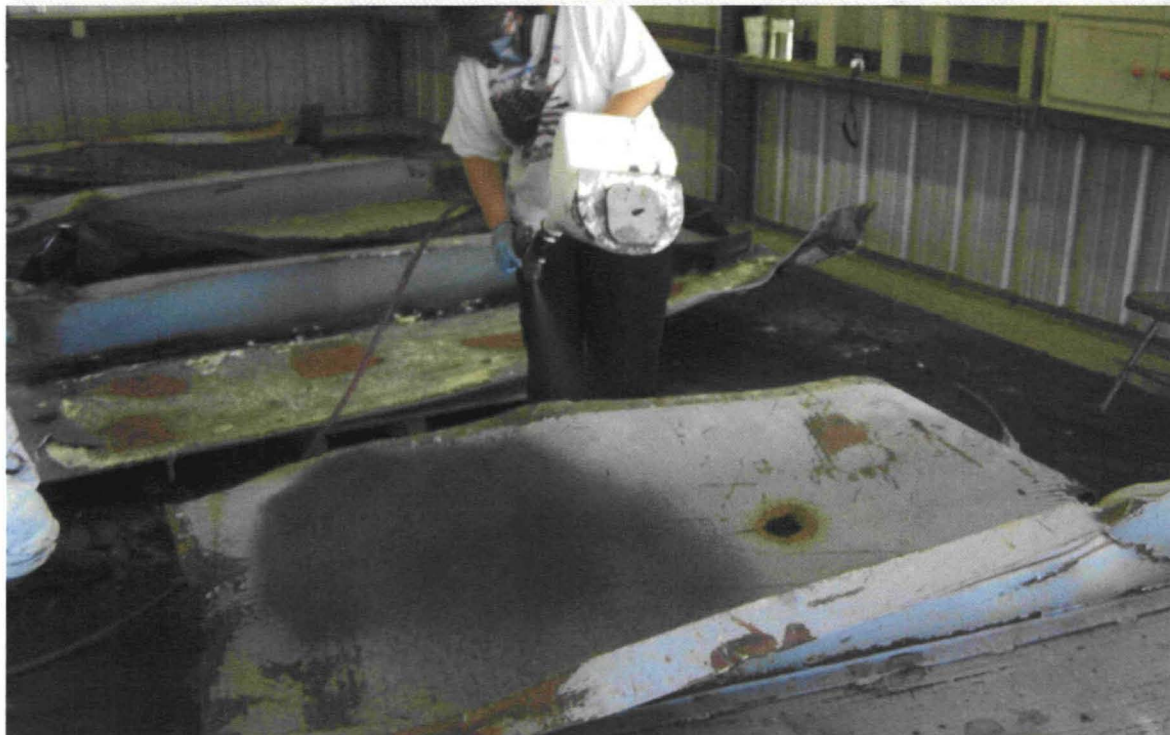
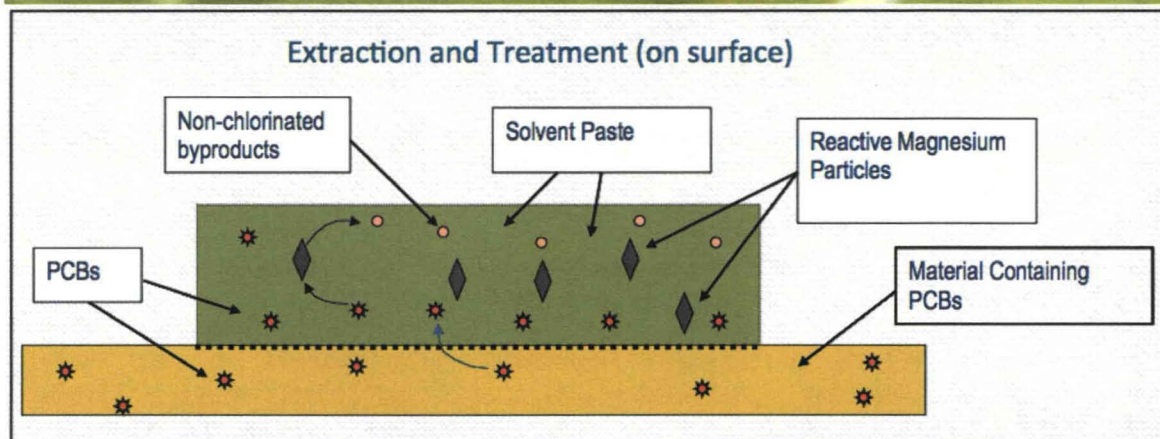


Emulsion for Metals in Groundwater/Sediment Systems

● Benefits:

- Has been shown in lab-scale tests to bind more than 99% of lead and degrade greater than 90% of PCBs in solution;
- Does not require the removal of soils/sediments for treatment;
- Is expected to be less expensive than "dig and haul" for remediating large areas;
- Produces benign by-products;

Activated Metal Treatment System for PCB Contaminated Structures



AMTS

● Benefits:

- Has been shown in lab-scale tests to remove greater than 99% of PCBs from Painted Structures
- Does not require the removal of paints after application.
- Is expected to be less expensive than demolition and TSCA disposal costs;
- Produces benign by-products;

Patenting and Commercial Activity

Technology	IP Status	Commercial Activity
Deep Wall Emplacement	US Patent No. 6,207,114	Marketing - Passive
Ultrasound	US Patent No. 6,013,232	Exclusive License ● EnviroMetal Technologies
EZVI	US Patent No. 6,664,298 US Application Serial No. 10/701,412 US Application Serial No. 10/701,410	Non-exclusive License ● GeoSyntec Consultants ● ASAT LLC ● Weston Solutions
Emulsion for Metal Treatment	US Application Serial No. 10/449,907	Marketing - Partnership Opportunity
Removal of PCBs from Ex Situ Structures	US Patent No. 7,271,199	Marketing
Activated Metal Treatment System (AMTS)	Patent Pending	Actively licensed TEA Bio-Blend Danish Company

Doing Business: Lessons Learned

- If one company has control over a market, gain buy-in from this company early.
- Know (and accept) the limits of your technology.
- Know when to quit active marketing.
- In collaborative technology development effort, make sure there is an in-house expert to work with a licensee.

Lessons Learned - Ultrasound

- If one company has control over a market, gain buy-in from this company early.
- A technology champion is essential for success.

Lessons Learned – EZVI

- Regulatory verification can be an important for gaining interest.
- A technology champion is essential for success.
- Fully understand your market, and competitive technologies.
- Careful identification and selection of licensing candidates.
- Promoting a technology too early can result in insecurity.
- A technology open house is a good method for generating interest.
- A web portal can provide a passive and inexpensive marketing.

Cross Case Lessons Learned

One Size Does Not Fit All

No one strategy or approach can work for all technology transfer projects.